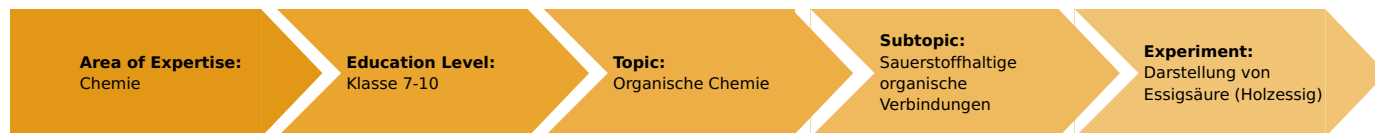


# The characterization of acetic acid "wood vinegar"

(Item No.: P7172700)

## Curricular Relevance



### Difficulty



Easy

### Preparation Time



10 Minutes

### Execution Time



10 Minutes

### Recommended Group Size



2 Students

### Additional Requirements:

### Experiment Variations:

### Keywords:

carboxylic acid, acetic acid, preparation of acetic acid

## Task and equipment

## Information for teachers

## Learning objectives

- Acetic acid is, among other substances, produced by the dry distillation of wood.
- This so-called wood vinegar is an acid and can be distinguished from other distillation products (e.g. methanol) with indicators.

## Notes on setup and procedure

### Preparation:

Coarse, dried sawdust or shavings are particularly suitable for the dry distillation, but other pieces of wood can also be used.

### Remarks on the students experiments:

Ensure that the apparatus is free of tension and has no leaks. If the number of work-places available in the fume hood is too small, then the emerging gas must be continually burnt with a wood splint. Nuisance caused by the smell and danger from the emerging methanol are almost completely avoided if a permanent combustion of the gas is maintained.



## Hazards

- Strongly smelling gases which are harmful to health are evolved during this experiment. Carry it out in a fume hood!
- Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so it can be easily inserted!

## Notes

The acetic acid is formed, just as the methanol, from the methoxy groups of the lignins. The acetic acid content of the distillate is approx. 6%, which is about three times higher than that of methanol.

## Remarks on the method

An indication that further decomposition products are formed should be given.

## Waste disposal

- Free the Duran test tube from organic decomposition products by mechanical cleaning followed by glowing it out for some time.
- The test tubes should not be cleaned by the students as the decomposition products contain carcinogenic substances.
- Put distillates in the container for combustible organic substances.

# The characterization of acetic acid "wood vinegar" (Item No.: P7172700)

## Task and equipment

### Task

#### How can acetic acid be won?

Produce "wood vinegar" by the dry distillation of wood.



Equipment



Position No.	Material	Order No.	Quantity
1	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
2	Support base, variable	02001-00	1
3	Glass beaker DURAN®, short, 250 ml	36013-00	1
4	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
5	Boss head	02043-00	2
6	Glass tube, right-angled w.tip, 10	36701-53	(1)
7	Protecting glasses, clear glass	39316-00	1
8	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
9	Universal clamp	37715-00	2
10	Glass tubes, right-angled, 10	36701-59	(1)
11	Pipette with rubber bulb	64701-00	1
12	Rubber tubing, i.d. 6 mm	39282-00	1
13	Test tube, 180x18 mm, 100pcs	37658-10	(1)
14	Test tube, 180x20 mm, side arm, PN19	36330-00	1
15	Spoon, special steel	33398-00	1
16	Test tube, 180x20 mm, DURAN, PN19	36293-00	1
	Butane burner f. cartridge 270+470	47536-00	1
	Butane cartridge CV 300 Plus, 240 g	47538-01	1
	Glycerol, 250 ml	30084-25	1
	Sodium chloride 1000 g	30155-70	1
	Iron wool 200 g	31999-20	1
	Wood splints, package of 100	39126-10	1
	Indicator paper, pH1-14, roll	47004-02	1
Additional material			
	Ice		
	Sawdust, dry		

## Set-up and procedure

### Set-up

### Hazards

- Strongly smelling gases which are harmful to health are evolved during this experiment. Carry it out in a fume hood!
- Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so it can be easily inserted!



### Setup

Set up the stand as shown in Fig. 1 with two boss heads and two universal clamps. Position the clamps on the support rod at different heights and at a right angle to each other.



Fig. 1

Ease the short arm of the large right-angled tube through the stopper for the Duran test tube (Fig. 2). Put the other stopper on the side-arm test tube and ease the long arm of the right-angled tube through it until the tip is about 3 cm above the bottom of the test tube (Fig. 3).



Fig. 2



Fig. 3

Fill the Duran test tube two thirds full with sawdust and fix it horizontally with the upper clamp (Fig. 4). Connect the two test tubes with each other with the right-angled tube, then fix the side-arm test tube vertically with the second clamp. Ensure that the two test tubes are well closed but that there is no tension in the connection (Fig. 5).



Fig. 4

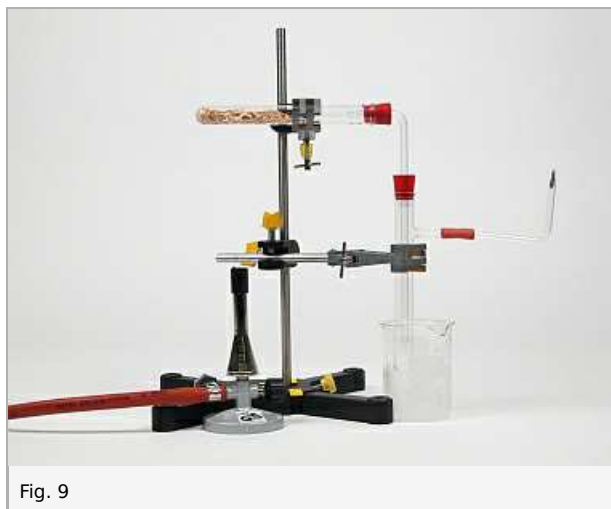


Fig. 5

Half-fill the beaker with ice and under stirring add several spoonfuls of sodium chloride (Fig. 6). Position the beaker under the side-arm test tube, which acts as a condenser, and adjust the high of the apparatus so that the bottom half of this test tube is immersed in the ice (Fig. 7).



Use a piece of rubber tubing to connect the side arm of the test tube with the right-angled tube with tip (an iron wool plug is inserted at the tip (Fig. 8) to act as a safety device against striking back) so that the tip points upwards (Fig. 9).



## Procedure

First heat the Duran test tube over its whole length, then heat the wood in the front part strongly. Little by little, move the Bunsen burner towards the bottom of the test tube.

Collect the gas which emerges through the tip and test if it is an explosive mixture (Fig. 10). If it is not explosive, ignite the gas at the tip.



Fig. 10

Stop heating the wood as soon when no more distillate forms in the condenser. Allow the condenser to cool, then remove the side-arm test tube and put it in the test tube rack.

Remove the brighter phase of the distillate with a pipette and put a few drops of it on pH-paper. Carefully test the smell of the distillate.



Fig. 11

## Waste disposal

Leave the test tubes in the test tube rack for cleaning. Do not clean them yourselves!



# Report: The characterization of acetic acid "wood vinegar"

## Result - Observations

Note the observations you make.

- a) On heating the wood.
- b) On examining the product.

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## Evaluation - Question 1

Draw conclusions from your observations.

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### Evaluation - Question 2

Name some of the properties of the formed product which are shown by this experiment.

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### Evaluation - Question 3

Which substances were produced with the same experimental setup and starting substance?

Complete the word equation.

By dry distillation of wood ....., ....., and ..... can be produced.